

GREEN GROWTH, JUST TRANSITION, AND GREEN JOBS: THERE'S A LOT WE DON'T KNOW

Greener growth, a just transition and green job creation are prominent in the global agenda today. However, we do not yet have a full understanding of the likely employment impacts of different policy options. This research brief reviews some of the most recent literature on green growth, green jobs and a just transition with a view to identify some of the main knowledge gaps and areas for future research.

Environmental sustainability and green growth figure prominently on the global agenda for sustainable development embodied in the Sustainable Development Goals.¹ The need to decouple growth and environmental degradation is made explicit in Target 8.4 under Goal 8, while other Goals highlight the need to take urgent action on climate change (Goal 13), promote sustainable production and consumption (Goal 12), and protect water and land ecosystems (Goals 14 and 15), among others.

The imperative of a just transition towards greener economies has been generally agreed upon. The transition to greener economies presents opportunities in terms of stimulating economic growth, creating decent jobs and contributing to social inclusion and poverty reduction. However, the transition also presents challenges, such as job displacements and job losses in declining industries with unclear net employment impacts, potentially adverse impacts on poor households from higher

¹ This brief was written by Fernanda Bárcia de Mattos of the Employment Policy Department, who would like to thank Claire Harasty for the guidance and comments, and Kamal Gueye and Marek Harsdorff for the helpful comments.

² World Bank: *Inclusive green growth: The pathway to sustainable development* (Washington D.C., 2012); Dechezleprêtre, A. and Sato, M.: "The impacts of environmental regulations on competitiveness", in *Review of Environmental Economics and Policy* (2017, Vol. 11, No.2),

energy and commodity prices and loss of livelihoods, and concerns over greening impacts on competitiveness.² Moreover, it is clear that green growth and transition to greener economies will have heterogeneous impacts across countries, sectors, and groups of workers.

Addressing these challenges and capitalizing on the opportunities require decisive policy action to manage change and ensure a just transition. These policies should, at once, promote economic gains, decent employment growth and environmental preservation, delivering a triple win. Against this background, this brief presents the result of a review of the recent green growth literature with a view to summarize existing evidence on employment impacts from green growth and just transition policies, suggesting where evidence is scarce and thus pointing to future areas for investigation.

Main policy options: reviewing the evidence

The main policy tools towards green growth and green job creation include macroeconomic market-based instruments and regulations which influence prices and thus economic activity; sectoral policies and support to enterprises to stimulate greener economic activity through support to investments and innovation and promotion of green entrepreneurship; skills and education policies to facilitate structural transformation by aligning the demand and supply of skills; social protection policies to mitigate adjustment costs, enable and promote environmental protection; and social dialogue for managing structural change.³

pp. 183-206; OECD: *Investing in climate, investing in growth* (Paris, 2017).

³ The relevance of policies directly addressing climate change and environmental impacts on labour and productivity must also be recognized, even though they are beyond the scope of this brief. This is one of the topics addressed in the ILO: *World Employment and Social Outlook 2018: Greening with jobs* (Geneva, forthcoming).

This section consolidates evidence from some of the most recent research on the employment impacts of these policies, adding to previous evidence-consolidation efforts.⁴

Macroeconomic policies, particularly fiscal measures, have been one of the main tools adopted to promote greener economies. Based on the premise that markets may fail to deliver the best outcomes for societies and the environment⁵, macroeconomic market-based policies for greener economies include taxes, subsidies, and trading schemes all of which aim to improve resource efficiency through impacts on the cost and price of goods and services which influence producers' and consumers' behaviour. Evidence suggests net impacts of market-based environmental policies are small and often positive.

Fiscal measures have been one of the most widely adopted policy options. Hafstead and Williams found that a pollution tax in the United States (US) has had minimal net impact on employment, in spite of significant job churning.⁶ Positive, if small, carbon tax-induced net employment impacts have been reported in Canada following the introduction of a revenue-neutral carbon tax in 2008.⁷ A study on the impact of United Kingdom's (UK) Climate Change Levy compared firms subject to the whole tax against those which received an 80 per cent discount on the levy by joining a voluntary climate change agreement.⁸ It concluded that large declines in electricity use did not affect employment, productivity or economic performance. Simulations for Australia suggest a carbon tax of \$23/ton of carbon could support the national goal of reducing carbon emissions by 80 per cent by 2050, with mild negative impacts on real economic growth and on employment (ranging from -0.6

per cent to -1.7 per cent depending on the occupation) unless complementary policies are set in place.⁹ Evidence from emerging and developing countries is scarce. A simulation of potential impacts of a carbon tax, accompanied by revenue recycling, in Mexico suggest potential increases in employment, GDP and wages, while decreasing emissions.¹⁰ Kuralbayeva examined the potential impact of a budget-neutral green tax – which raises a pollution tax while reducing payroll taxes – on the labour market of a country with a large informal sectoral and rural-urban migration.¹¹ The findings indicate an environmental tax can reduce unemployment if tax revenue is recycled to reduce payroll taxes, thus decreasing the price of labour.

Another common policy instrument is cap-and-trade. A cap-and-trade system has been implemented in the European Union (EU) since 2005, covering energy-intensive manufacturing and power generation. The system has led to significant reductions in emissions with minimal impact on employment in 18 countries between 2004-08 – 0.9 per cent reduction in regulated sectors versus non-regulated sectors.¹² A study on the employment impacts of the US cap-and-trade sulphur dioxide programme covering the power sector found no significant decreases in employment.¹³ Research on a nitrogen dioxide trading programme in the US suggests employment in energy-intense manufacturing declined 1.3 per cent, but rather than through increased separation, employment decreased primarily through lower hiring rates.¹⁴

Policy options at the macro level also include regulatory measures, such as standard setting, labelling, prohibitions and compliance, planning rules and building regulations, among

⁴ Including, among many others, the ILO report to the ILC 102nd Session (2013) *Sustainable development, decent work and green jobs*, in addition to upcoming publications such as the forthcoming *World Employment and Social Outlook 2018* cited above. Moreover, this brief focuses on public policies though private entities have also been adopting green measures that impact employment.

⁵ INTOSAI Working Group on Environmental Auditing: *Market based instruments for environmental protection and management* (Jakarta, 2016).

⁶ Hafstead, M. and Williams III, R.: *Unemployment and environmental regulation in general equilibrium*, NBER Working Paper 22269 (Cambridge, 2016).

⁷ Yamazaki, A.: *Jobs and climate policy: Evidence from British Columbia's revenue-neutral carbon tax* (University of Calgary, 2015). http://econ.ucalgary.ca/sites/econ.ucalgary.ca/files/workingpapers/yamazaki_jobs_and_climate_policy_dec2015.pdf [accessed 29 Nov. 2017].

⁸ Martin, R., de Preux, L. B. and Wagner, U. J.: *The Impacts of the Climate Change Levy on Manufacturing: Evidence from microdata*, NBER Working Paper No. 17446 (Cambridge, 2011).

⁹ McNeill, J., Meng, X. and Siriwardana, M.: "The environmental and employment effect of Australian carbon tax", in *International Journal of Social Science and Humanity* (2015, Vol. 5, No. 6), pp. 514-519.

¹⁰ Landa Rivera, G. et al.: "Towards a low carbon growth in Mexico: Is a double dividend possible? A dynamic general equilibrium assessment", in *Energy Policy* (2016, Vol. 96), pp. 314–327.

¹¹ Kuralbayeva, K.: *Effects of carbon taxes in an economy with large informal sector and rural-urban migration*, GRI Working Paper No. 139 (London, Grantham Research Institute, 2013)

¹² Muûls, M. et al.: *Evaluating the EU Emissions Trading System: Take it or leave it? An assessment of the data after 10 years*, Grantham Institute Briefing Paper No. 21 (London, Imperial College London, 2016).

¹³ Ferris, A., Shadbegian, R., and Wolverton, A.: "The effect of environmental regulation on power sector employment: Phase I of the Title IV SO₂ trading program", in *Journal of the Association of Environmental and Resource Economists* (2014, Vol. 1, No. 4), pp. 521-553.

¹⁴ Curtis, M.: *Who loses under power plant cap-and-trade programs?*, NBER Working Paper 20808 (Cambridge, 2014).

others.¹⁵ A study of five resource-dependent Chinese provinces indicates environmental regulation has had positive direct and indirect (by inducing industrial upgrades) impacts on employment.¹⁶ A literature review of studies on the effects of environmental regulation of pollution-intensive firms in the US found negligible or no impacts on employment and productivity.¹⁷ In Brazil, land use policies aimed at improving energy efficiency and renewable energy could lead to an employment expansion of 1.3 per cent yearly between 2010-30.¹⁸

Sectoral and industrial policies can also be used to promote green growth and green job creation. Policies such as feed-in tariffs, research and development (R&D) support, and subsidised loans facilitate the growth of environmentally friendly industries and a change in the distribution of employment, as well as job creation, towards these sectors. Most of the policy evidence has focused on the renewable energy sector. In 2008, the Indian government established the Jawaharlal Nehru National Solar Mission, with the goal of enabling the development of affordable solar energy in the country.¹⁹ It set out a set of complementary policies including feed-in tariffs, tax incentives, preferential loan schemes, renewable energy purchase obligations, and local content requirements. As a result, the installed solar capacity has risen sharply, from virtually zero to 5,130 MW by January 2016 with KWh costs on par with that of coal energy with about 121 thousand solar photovoltaic jobs in 2017.²⁰ However, measures have not been as successful in promoting the development of local photovoltaic cell and module manufacturing industry.²¹ China has also been investing heavily in solar energy, having

announced in 2017 over \$360 billion in new investments by 2020, with the aim of creating over 13 million jobs in the sector.²² A recent study on the sector found that a 1 TWh expansion of solar photovoltaic and wind power would create up to 45.1 thousand direct jobs and 15.8 thousand indirect jobs in the country.²³ However, not accounting for induced job impacts (i.e. jobs in other sectors not in this value chain but which are influenced by energy prices and related resource transfers) could lead to overly optimistic projections, as noted by the authors. In Morocco, national policies for the development of renewable energy encourage foreign investments, the development of the domestic supplier industry, and support skills development at the technical and tertiary levels.²⁴ The first phase of the Noor-Ouarzazate Concentrated Solar Power project led to the creation of 1,800 construction jobs and 250 operations jobs, with an even greater number of jobs expected in the next two phases of the project.²⁵ In addition, incentives to the private sector have, for instance, led to a Siemens Wind Power and Renewables manufacturing plant for blades, generating 1,100 direct and indirect jobs.²⁶

Although limited, and often dated, evidence from other sectors is encouraging. An ILO project in Zambia has, since 2013, undertaken activities to raise awareness and increase demand for green construction, promote an industry-specific regulatory framework to stimulate demand for green construction materials and techniques as well as measures to improve the capacity of local firms. As a result, by 2015, over 2,600 green jobs had been created in the Zambian construction sector.²⁷ The agricultural sector has also been the target of greening policies. In the US, the Business and Industry Guarantee Loan Program aims at

¹⁵ UNDESA: *A guidebook to the Green Economy, Issue 3: Exploring green economy policies and international experience with national strategies* (New York, 2012); Frankhauser, S. and Stern, N.: *Climate change, development, poverty and economics*, Centre for Climate Change Economics and Policy Working Paper No. 284 (London, 2016).

¹⁶ Cao, W., Wang, H. and Ying, H.: "The effect of environmental regulation on employment in resource-based areas of China – An empirical research based on the mediating effect model", in *International Journal of Environmental Research and Public Health* (2017, Vol. 14, No. 12: 1598).

¹⁷ Ferris, A. et al.: *The impacts of environmental regulation in the US economy*, Working Paper 17-01 (Washington D.C., US Environmental Protection Agency National Center for Environmental Economics, 2017).

¹⁸ Gouvello, C.: *Brazil low-carbon country case study* (Washington D.C., World Bank, 2010).

¹⁹ Ministry of New and Renewable Energy (MNRE): *Jawaharlal Nehru National Solar Mission: Toward building Solar India*, http://www.mnre.gov.in/file-manager/UserFiles/mission_document_JNNSM.pdf [accessed 29 Jan. 2018].

²⁰ Partnership for Action on Green Economy (PAGE): *Green industrial policy: Concept, policies, country experiences* (Geneva, 2017);

International Renewable Energy Agency (IRENA): *Renewable Energy and Jobs: Annual Review 2017* (Abu Dhabi, 2017).

²¹ IRENA: *Renewable Energy and Jobs: Annual Review 2017*, op. cit.; PAGE: *Green industrial policy: Concept, policies, country experiences*, op. cit.

²² Reuters: "China to plow \$361 billion into renewable fuel by 2020", in *Reuters*, 5 Jan. 2017, <https://www.reuters.com/article/us-china-energy-renewables/china-to-plow-361-billion-into-renewable-fuel-by-2020-idUSKBN14P06P> [access 8 Jan. 2018].

²³ Cai, W. Et al.: "Employment impacts of renewable energy policies in China: A decomposition analysis based on a CGE modelling framework", in *Applied Energy* (2018, Vol. 210), pp. 256-267.

²⁴ PAGE: *Green industrial policy: Concept, policies, country experiences*, op. cit.

²⁵ IRENA: *Renewable energy and jobs: Annual Review 2016* (Abu Dhabi, 2016).

²⁶ L'Usine Africaine: "Siemens Gamesa inaugure son usine de pales d'éoliennes à Tanger, in *L'Usine Africaine*, 11 Oct. 2017, <http://usineafricaine.com/siemens-gamesa-inaugure-usine-de-pales-deoliennes-a-tanger/> [accessed 30 Jan. 2018].

²⁷ ILO: *Green Jobs Programme Annual Impact Report Zambia 2015* (Lusaka, 2015).

creating employment in rural communities and prioritizes loans and loan guarantees for locally and regionally produced agricultural food products (sold at less than 400 miles from the production location). A programme evaluation indicates strong correlation between loan recipient counties and employment growth, although these jobs have been associated with lower than average wages.²⁸

Measures in support of innovation may promote technical change in traditional sectors as well as new sectors, with more ambiguous impacts on the distribution of employment across industries – new technologies and processes may be more or less labour intensive or require different skills. Support to environmentally friendly innovation has been adopted across the world as reflected by the *Mission Innovation* global initiative to double national investments in R&D signed by over 20 countries – ranging from Australia, to India, to the United Arab Emirates – in 2015. Employment impacts of environmental product and process innovations are, however, uncertain. Horbach's review of research on eco-innovation and employment suggests impacts depend on the nature of innovation.²⁹ He argues that the introduction of cleaner processes may have labour-saving impacts, while new end-of-pipe measures may require additional workers. In turn, product innovations can improve business competitiveness and thus demand, with positive impacts on firm-level employment whereas macro-level impacts depend on the labour intensiveness of the substituted good. An analysis of environmental innovation and employment in Germany finds that innovative firms have generally more dynamic employment development; in particular, process innovation can improve business competitiveness and thus demand.³⁰ A firm-level study on Italian manufacturing firms found green innovations had substantially larger effects on long-run job creation than other types of innovation.³¹ Licht and Peters analysed data for 16 European countries and concluded that product innovation has significant positive impacts on employment, but find no

difference between eco- and other innovation; in turn, process innovation has minor employment impacts.³²

Spurring the transition to greener economies and promoting the creation of green-jobs requires additional support to enterprises, beyond incentives for innovation and industrial development. This includes support to investments and **entrepreneurship and small and medium enterprises (SMEs)**. On the one hand, greener SMEs are critical for greener economies, and on the other hand, environmental practices, products and services present opportunities for SMEs. Support to SMEs has been, for instance, instrumental in job creation in the green construction sector in Zambia, through the project mentioned above. Although the evidence on employment creation from policies in support of green SMEs is limited, several studies highlight common challenges faced by green entrepreneurs. It has been noted that SMEs are often unaware of potential benefits of greener practices and activities, lack information on relevant regulations and policy incentives, and tend to associate environmental sustainability with complexity and high costs.³³ A three-year study on 1,300 social and environmental SMEs in developing countries found these firms face barriers to scaling activities, including high cost of capital, limited R&D support, concerns over intellectual property rights and lack of skilled workers.³⁴ A recent study on the ecosystem for green entrepreneurship in Morocco indicates limited business skills hamper the growth of green SMEs; it also highlights the lack of awareness of programmes and incentives, limited funding and later-stage support, and the need for increased market information.³⁵ A study of green entrepreneurs in South Africa describes similar challenges, including lack of skilled labour, and limited access to financial resources and markets.³⁶

The development of new, greener, technologies and industries must be accompanied by **skills and education policies**. The studies reviewed above suggest environmental policies have small net employment impacts; this, however, may mask significant job churning as the structure of the economy and of

²⁸ OECD: *Policy instruments to support green growth in agriculture* (Paris, 2013)

²⁹ Horbach, J.: "Impacts of regulation on eco-innovation and job creation", in *IZA World of Labor* (2016, June), pp. 265-265.

³⁰ Horbach, J., and K. Rennings: "Environmental innovation and employment dynamics in different technology fields: An analysis based on the German Community Innovation Survey 2009", in *Journal of Cleaner Production* (2013, Vol. 57), pp. 158–165.

³¹ Gagliardi, L., Marin, G., and Miriello, C.: "The greener the better? Job creation effects of environmentally-friendly technological change", in *Industrial and Corporate Change* (2016, Vol. 25, No. 5), pp. 779-807.

³² Licht, G. and Peters, B.: *The impact of green innovation on employment growth in Europe*, WVVforEurope Working Paper No. 50 (Vienna, 2013), http://www.foreurope.eu/fileadmin/documents/pdf/Workingpapers/WVVforEurope_WPS_no050_MS53.pdf [accessed 19 Jan. 2018].

³³ OECD: *Environmental policy toolkit for greening SMEs in EU Eastern Partnership countries* (Paris, 2015).

³⁴ Creech, H. et al.: "Small-scale social-environmental enterprises in the green economy: supporting grassroots innovation", in *Development in Practice* (2014, Vol. 24, No. 3), pp. 366-378.

³⁵ World Bank: *Igniting climate entrepreneurship in Morocco: Findings from the Climate Entrepreneurship and Innovation Ecosystem Diagnostic* (Washington D.C., 2017), <http://documents.worldbank.org/curated/en/133881493719194269/pdf/114718-WP-PUBLIC-1-5-2017-17-4-3-moroccoceedApril.pdf> [accessed 5 Feb. 2018].

³⁶ Agster, R., Heuer, A. and Slavova, M.: *Growing green and inclusive entrepreneurship for sustainable development in South Africa* (Berlin, SEED, 2015), <https://www.seed.uno/publications/policy-insights/1907.html> [accessed 5 Feb. 2018].

industries change. Structural change towards new industries may require industry-specific skills. At the same time, greener processes and products within existing industries may require new skills for old jobs. These imply the critical need to retrain workers and train the future workforce in relevant skills in order to enable the transition to a greener economy. Employability of workers with green skills will continue to rise as societies transition to greener economies.³⁷

Changes in skills demand and whether workers are able to transfer skills across sectors will be a key determinant of the labour market costs of the transition to greener economies. In fact, one of the most common concerns across the literature lies in potential skills shortages.³⁸ A dearth of skilled workers has been identified in several countries. Strietska-Ilina et al. identified skills shortages for emerging occupations as well as changing skills profiles of traditional occupations in their analysis of 21 countries' experiences.³⁹ The research indicates a general lack of STEM graduates, as well as limited supply of skilled workers due to lack of interest in sectors such as waste management. Shortages have been reported for photovoltaic workers in Germany, and smart grid engineers in the UK.⁴⁰ Schwartz, Andres and Dragoiu analysis of Brazil, Honduras and Peru highlight the high skill-intensiveness of greening projects undertaken in these countries could lead to skills shortages.⁴¹ More recently, the Asian Development Bank (ADB) identified green skills shortages through surveys in India, Indonesia, and Sri Lanka.⁴² Results from the survey in India indicate over 60 per cent of energy sector respondents are facing a shortage of skilled workers in energy-efficient construction and retrofitting, renewable energy and energy efficiency, as well as in environmental services. The survey in Indonesia concluded skills shortages are hampering businesses in construction and hospitality, but less than one-third of respondents from all sectors are hiring new workers or retraining their workers for green jobs. In Sri Lanka, respondents from energy, construction

and transport sectors reported a dearth of green skills is already impacting businesses.

It is complicated to measure green skills, which often apply to various sectors and disciplines.⁴³ Many skills are not necessarily green per se, but depend on the context in which they are applied, and thus traditional skills remain relevant. Overall, skills strategies for greener economies must be aligned with other policies for green growth. Empirical evidence on green skills policy impacts and on the effect of green policies on skills is scant. A simulation exercise by the OECD suggests low-skilled workers will face job churning to the largest degree given the incidence of low-skilled work in energy-producing sectors, particularly in emerging countries.⁴⁴ At the same time, net employment gains are expected to be highest for medium- and high-skilled workers. Consoli et al. found that in spite of limited net impacts on employment, environmental regulation in the US has had significant impacts on demand for skills, particularly increasing demand for engineering and technical skills related to the development, production, management and monitoring of technology.⁴⁵ The research also concluded, however, that the skills required in green jobs are of the same level as those required for brown jobs and that, thus, education and training policies should focus on specific technical programs rather than on the development of advanced education programs. Moreover, the ease of transition will be partly related to the transferability of skills across sectors, allowing (or not) for smooth worker mobility.⁴⁶

Skills and education policies for a green transition have been implemented in several countries. In France, the National Observatory for Green Economy and Skills forecasts impacts of the green transition with a focus on employment and skills.⁴⁷ In Australia, the government has added sustainability and green skills courses to technical and vocational education and training options, including new certificates in business and home sustainability assessment and environmental management and

³⁷ UNESCO-UNEVOC: *Greening technical and vocational education and training: A practical guide for institutions* (Bonn, UNESCO, 2017).

³⁸ Aceleano, M. et al: "Employment policies for a green economy at the European Union level", in *Sustainability* (2015, Vol.7, No. 7), pp. 9231-9250; Agence Française de Développement (AFD): *Facilitating green skills and jobs in developing countries*, Technical Reports No. 9 (Paris, 2015); Bowen, A.: *'Green' growth, 'green' jobs and labour markets*, Centre for Climate Change Economics and Policy Working Paper No.88 (London, CCCEP, 2012); IRENA: *Renewable energy and jobs* (Abu Dhabi, 2013); Strietska-Ilina, O. et al.: *Skills for green jobs: A global view* (Geneva, ILO, 2011).

³⁹ Strietska-Ilina, O. et al.: *Skills for green jobs: A global view*, op. cit. An updated study covering 30 countries is expected for 2018.

⁴⁰ World Bank: *Inclusive green growth: the pathway to Sustainable Development*, op. cit.

⁴¹ Schwartz, J.Z., Andres, L.A., and Dragoiu, G.: *Crisis in Latin America: Infrastructure investment, employment and the expectations of stimulus*,

Policy Research Working Paper WPS 5009 (Washington D.C., World Bank, 2009).

⁴² Maclean, R., Jagannathan, S. and Panth, B.: *Education and skills for inclusive growth, green jobs and the greening of economies in Asia: Case study summaries of India, Indonesia, Sri Lanka and Viet Nam* (Singapore, ADB and Springer, 2018).

⁴³ AFD: *Facilitating green skills and jobs in developing countries*, op. cit.

⁴⁴ OECD: *Investing in climate, investing in growth*, op. cit.

⁴⁵ Consoli, D. et al.: *Environmental regulation and green skills: an empirical exploration*, <https://pdfs.semanticscholar.org/7737/fecd75b777872791ac79b77f4b0a7ab1eb2f.pdf> [accessed 9 Jan. 2018].

⁴⁶ OECD: *Employment implications of green growth: Linking jobs, growth and green policies*, op. cit.

⁴⁷ *ibid.*

sustainability, among others⁴⁸. Brown highlights several enterprise-led training activities in Australia which aim to raise employee awareness of climate change and promote greener on-the-job practices.⁴⁹ In Morocco, youth receive technical and vocational training to become energy technicians in centres set up through the German Climate Initiative, in line with Morocco's national plans towards renewable energy.⁵⁰ In addition, new networking platforms linking educational institutions and business aim to better align demand and supply of skills.⁵¹ In July 2017, the government of Karnataka, India, partnered with the Center for Sustainable Development and launched a Green Skills Academy to provide skilling and re-skilling for workers in 12 sectors.⁵² In Guyana, public and private institutions have reviewed and revised curricula to better prepare graduates as the economy becomes greener.⁵³

Mitigating adjustment costs also necessitates strong **social protection** systems. Indeed, regulatory changes may lead to job declines in regulated sectors, requiring support to displaced workers as they transition to new jobs. Moreover, one of the most common concerns in the green growth literature is that environmental policies may be regressive, disproportionately impacting the poor. It has been noted, for instance, that environmental pricing and regulations, such as price increases in water and fuel or pollution and waste regulations, could disproportionately affect lower-income populations.⁵⁴ In addition, lower-income people typically have greater reliance on environmental capital, such as agriculture, and have lower capacity to adapt.⁵⁵ Barbier highlights some of the reforms in sub-Saharan Africa which, in spite of expected long-term gains, may negatively impact the poor in the short-term – such as discouraging coal energy in Southern Africa or regulations on fertilizers in Malawi.⁵⁶ Strong social protection systems are critical in addressing these concerns.

⁴⁸ See for instance TAFE NSW-Northern Sydney, <http://www.nsi.tafensw.edu.au/courses/typesofcourses/greenskills.aspx> [accessed 18 Jan. 2018].

⁴⁹ Brown, M.: "Developing and using green skills for the transition to a low carbon economy", in *Australian Journal of Adult Learning* (2015, Vol. 55, No. 2), pp. 182-203.

⁵⁰ GIZ: *Energised: Jobs with a future in Morocco*, 11 Oct 2017, <https://www.giz.de/en/mediacenter/57580.html> [accessed 29 Jan. 2018].

⁵¹ PAGE: *Green industrial policy: Concept, policies, country experiences*, op cit.

⁵² The Times of India: "CDS launches green skills academy", in *The Times of India*, 19 July 2017, <https://timesofindia.indiatimes.com/city/bengaluru/csd-launches-green-skills-academy/articleshow/59665949.cms> [accessed 16 Feb. 2018].

⁵³ ILO: *Skills for green jobs study – Guyana* (Port of Spain, 2017).

⁵⁴ Dercon, S.: *Is green growth good for the poor?*, World Bank Policy Research Working Paper No. 6936 (Washington D.C., 2014).

Several countries have adopted tools to mitigate potentially regressive impacts of environmental policies. Many successful examples are summarized in a recent report by the Global Green Growth Institute.⁵⁷ In Indonesia, for over 30 years, fossil fuel subsidies were larger than the combined government expenditure on education, social protection and health. Recently, the government has started to phase out these subsidies, re-wiring the funds to widen the social safety net, including public health insurance and conditional cash transfers, among others. In Mexico, incremental shifts in energy policy coupled with cash transfers have led to achievements in sustainability while mitigating negative impacts on lower income groups.

There are also increasingly examples of countries implementing social protection policies as a tool for environmental protection. In Brazil, *Bolsa Verde* is a conditional cash transfer linking payments to conservation practices in environment-dependent communities in rural areas.⁵⁸ In South Africa, the *Working for* programmes, such as Working for Water, employ low-income populations and other disadvantaged groups such as youth and persons with HIV, in environmental preservation work providing a source of income and skills in environmental resource management.⁵⁹ In Mexico, *Pago por Servicios Ambientales Hidrológicos* provides payments to landowners, indigenous communities and communal land users (*ejidatarios*) for preserving forest coverage with the goal of increasing ground water quantity and quality, and reducing the risk of landslides.⁶⁰

In addition, although not necessarily a result of policies, climate change may have impacts on jobs and productivity which require mitigating measures, including climate insurance and protection. One example is Index-Based Livestock Insurance in Ethiopia and Kenya, which offers insurance to livestock farmers

⁵⁵ Frankhauser, S.; Stern, N.: *Climate change, development, poverty and economics*, Centre for Climate Change Economics and Policy Working Paper No. 284 (London, 2016).

⁵⁶ Barbier, E.: *Is green growth relevant for poor economies?*, Development Policies Working Paper 144. (Clermont-Ferrand, Fondation pour les études et recherches sur le développement international, 2015)

⁵⁷ Bass S. et al.: *Pro-poor, inclusive green growth: experience and a new agenda* (Seoul, GGGI, IIED and GEC, 2016).

⁵⁸ Ministério do Meio Ambiente: *Bolsa Verde*, <http://www.mma.gov.br/desenvolvimento-rural/bolsa-verde> [accessed 15 Feb. 2018].

⁵⁹ Department of Environmental Affairs, South Africa: *Working For Programmes*, <https://www.environment.gov.za/projectsprogrammes#workingfor> [accessed 15 Feb. 2018].

⁶⁰ Diekmann, K., van Panhuys, C. and Schwarzer, H.: *Protecting people and the environment: Lessons learnt from Brazil's Bolsa Verde, China, Costa Rica, Ecuador, Mexico, South Africa and 56 other experiences*, ESS Working Paper No. 54 (Geneva, ILO, 2016).

in case of drought.⁶¹ Distributional concerns can also be addressed by recycling revenue from macroeconomic instruments. Revenue generated by policy instruments, such as environmental taxes, may allow for greater social investments or for the reduction in other taxes such as income or labour (payroll) taxation mitigating potentially negative impacts of environmental pricing and regulation policies. Two studies focused on a potential \$25/ton carbon tax (rising at 2 per cent per year in real terms) in the US suggest significant potential revenue of between \$1.2 and \$1.6 trillion in the next ten years.⁶² Other examples include simulations in Mexico and in a country with a large informal sectoral and rural-urban migration highlighted in the discussion on macroeconomic measures above.

An important aspect of the transition to a green economy and creation of green jobs refers to the quality of jobs created. Indeed, green jobs are, by definition, decent jobs, i.e. a subset of jobs in environmental sectors which provide adequate wages, safe working conditions, safeguard workers' rights and social dialogue, and which provide social protection.⁶³ However, evidence on green policy impacts on job quality is minimal. GHK's assessment of green jobs in Bangladesh indicates that of the 3.5 million environmental-related jobs in the country, 800,000 meet decent work standards equivalent to approximately 2 per cent of employment in the country.⁶⁴ Research on Germany and Spain suggest jobs in renewable energy tend to be permanent full-time positions, associated with quality jobs.⁶⁵ Anecdotal evidence suggests sustainable agriculture methods, such as controlled use of pesticides, lead to better occupational safety and health. Similarly, it has been argued that waste management and recycling jobs are of

inherently better quality than those in waste incineration or landfills.⁶⁶

Finally, as highlighted in the *Guidelines for a just transition towards environmentally sustainable economies and societies for all*, adopted by the ILO in 2015, it is fundamental to build social consensus on the goal and pathways to sustainability. This requires social dialogue mechanisms for policy-design and implementation.⁶⁷ The multi-stakeholder Task Force on Green Jobs and Climate Change in India provided opportunities for the participation of social partners, including workers' and employers' organizations, in the development of the National Action Plan on Climate Change.⁶⁸ Since 2003, a National Conference on the Environment has been convened four times to include workers' and employers' organizations and civil society actors in discussions on the formulation and implementation of sustainable development policies in the Brazil.⁶⁹ In 2011, the Government of South Africa and social partners signed the Green Economy Accord, committing to work together to achieve goals such as the creation of 300,000 green jobs by 2020.⁷⁰

Conclusion

Evidence of green policy employment impacts is limited, oftentimes dated, and frequently relates to simulations rather than empirical evidence. Most of the research focuses on the energy sector, whereas green transitions are expected to impact other economic sectors, such as agriculture, construction and manufacturing. In addition, most of the existing evidence relates to high-income countries, with limited empirical research on emerging and developing countries. This literature review yielded virtually no evidence on the quality of jobs created, an

⁶¹ Churchill, C: "Why financial services matter in the fight against climate change", in *ILO Blog*, 28 Feb. 2018, <https://iloblog.org/2018/02/28/why-financial-services-matter-in-the-fight-against-climate-change/> [accessed 24 April 2018].

⁶² Marron, D., Toder, E. and Austin, L.: *Taxing carbon: What, why, and how* (Washington D.C., Urban Institute and Brookings Institution Tax Policy Center, 2015), <http://taxpolicycenter.org/publications/url.cfm?ID=2000274> [accessed 4 Jan. 2018]; Williams, R.C., III.: *Environmental taxation*, RFF Discussion Paper 16-24 (Washington D.C., Resources for the Future, 2016).

⁶³ ILO: *Green Jobs: Draft guidelines for the statistical definition and measurement of employment in the environmental sector*, Conference paper, 19th International Conference of Labour Statisticians (Geneva, 2013).

⁶⁴ GHK: *Estimating green jobs in Bangladesh* (Geneva, ILO, 2010), http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_159433.pdf [accessed 10 Mar. 2017].

⁶⁵ ILO: *Sustainable development, decent work and green jobs*, Report to the International Labour Conference 102nd Session (Geneva, ILO, 2013).

⁶⁶ Poschen, P.: *Decent work, green jobs and the sustainable economy: Solutions for climate change and sustainable development* (Geneva, ILO, 2015).

⁶⁷ For a more thorough review of experiences on social dialogue for sustainable development, see ILO: *Social dialogue for sustainable development: A review of national and regional experiences* (Geneva, 2012).

⁶⁸ ILO: *Sustainable development, decent work and green jobs*, Report of the Committee on Sustainable Development, Decent Work and Green Jobs of the International Labour Conference 102nd Session (Geneva, 2013), http://www.ilo.org/wcmsp5/groups/public/@ed_norm/@relconf/documents/meetingdocument/wcms_216378.pdf [accessed 19 Apr. 2018].

⁶⁹ Ministério do Meio Ambiente, Brasil: *Conferência Nacional do Meio Ambiente*, <http://www.mma.gov.br/responsabilidade-socioambiental/conferencia-nacional-do-meio-ambiente> [accessed on 19 Apr. 2018].

⁷⁰ Economic Development Department, Republic of South Africa: *Green Economy Accord*, <http://www.sagreenfund.org.za/wordpress/wp-content/uploads/2015/04/Green-Economy-Accord.pdf> [accessed 19 Apr. 2018].

important aspect of the green transition. At the same time, statistics on job creation most often do not consider whether these are sustainable, permanent, positions or temporary jobs. Another caveat is that some studies may look at direct job creation, while others may account for indirect and induced jobs; in addition, some look only at jobs created while others look into net employment impacts, thus taking into accounts jobs lost. Indeed, better understanding job losses and shifts in productivity due to structural transformations as well as those resulting from climate change is critical. Furthermore, although environmental challenges have a clear gender dimension, given the preponderance of women in activities such as gathering water and fuel, gender considerations and the promotion of equitable outcomes have not been incorporated in most of the policy analysis. Similarly, issues related to the concerns and contributions of indigenous populations to environmental preservation are also generally missing.

In sum, while the concepts of greener economies, a just transition and green job creation are prominent in the global agenda, we do not yet have a full understanding of the likely employment impacts of different policy options. Many questions remain unanswered, including how many, where and what kinds of jobs will be created (in terms of occupations and job quality), which skills these will require, and how best to prepare workers for labour market changes and minimize adjustment costs. It is, however, clear that promoting a just transition to greener economies requires comprehensive strategies, with coordinated and complementary measures including social dialogue as a foundation for a just transition for all; macroeconomic policies; sectoral and industrial policies; support to enterprises; education and skills development; as well as social protection policies to mitigate adjustment costs.

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